

### REMARKS

Claims 60-105 are pending in the present application. In the Office Action dated June 23, 2004, the Examiner rejected claim 60 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,634,927 to Molnar ("Molnar"). Claim 61 was rejected under 35 U.S.C. 103(a) as being unpatentable over the Molnar reference in view of U.S. Patent No. 6,572,453 to Wijekoon et al. ("Wijekoon"). Claims 62-83 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Molnar reference. Claims 84-105 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Molnar reference in view of Wijekoon reference.

### Embodiments Disclosed in the Present Application

The embodiments disclosed in the present application will now be discussed in comparison to the cited references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the cited references, do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

The various embodiments of the present invention are directed to planarizing microelectronic substrate assemblies on fixed abrasive polishing pads with non-abrasive planarizing solutions. A planarizing machine includes a support table, a fixed-abrasive polishing pad having a body disposed on the support table, a planarizing surface on the body, and a plurality of abrasive particles fixedly attached to the body at the planarizing surface. The planarizing machine includes a carrier assembly having a carrier head configured to hold a substrate and a drive mechanism attached to the carrier head to move the carrier relative to the polishing pad. The planarizing machine further includes a lubricating planarizing solution without abrasive particles.

In one embodiment, the planarizing machine is configured to deposit the lubricating planarizing solution without abrasive particles onto the polishing pad. The planarizing machine includes a first container and a supply of non-abrasive solution therein and a second container and a supply of non-abrasive lubricant-additive therein. A mixing site is coupled to the first and second containers, the non-abrasive lubricant-additive being mixed with non-abrasive solution at the mixing site to produce the non-abrasive lubricating planarizing

solution. The non-abrasive lubricating planarizing solution may be dispensed from the mixing site onto the polishing pad by a nozzle.

In one particular embodiment, the non-abrasive lubricating planarizing solution is formed by dissolving a lubricant-additive into a non-abrasive solution to form the lubricating planarizing solution, and then depositing the non-abrasive lubricating planarizing solution onto the polishing pad as the substrate moves relative to the polishing pad. The lubricant-additive may be glycerol, polyethylene glycol, polypropylene glycol, CARBOPOL (manufactured by B.F. Goodrich), polyvinyl alcohol, POLYOX (manufactured by Union Carbide), or some other lubricating liquid. The concentration of the lubricant-additive in the non-abrasive solution is selected so that the lubricating planarizing solution has a viscosity of at least approximately between 4-100 cp, and more generally between 10-20 cp. The non-abrasive lubricating planarizing solution provides a protective boundary layer between the front face of the substrate and the abrasive planarizing surface to inhibit the fixed abrasive from overly abrading or otherwise damaging the substrate.

In operation, the front face of the substrate is pressed against the lubricating planarizing solution and at least a portion of the planarizing surface of the polishing pad. At least one of the polishing pads or the substrate assembly is then moved with respect to the other to impart relative motion therebetween. As the substrate assembly moves relative to the polishing pad, regions of the front face are separated from the abrasive particles in the polishing pad by a lubricant-additive in the planarizing solution.

### **Cited References**

The Examiner has cited the Molnar reference. The Molnar reference discloses a support 40, a finishing element 24 that rotates in direction 4 disposed on the support 40. A finishing composition 30 is disposed between the finishing element 24 and a workpiece 20. The workpiece 20 rotates in direction 6. The Molnar reference discloses various compositions for the finishing composition 30. One preferred composition for the finishing composition 30 lacks abrasives. The Molnar reference does not appear to disclose a non-abrasive lubricating planarizing solution without abrasive particles on the polishing pad, the lubricating planarizing solution having a viscosity of at least approximately between 4-100 cp.

The Examiner has also cited the Wijekoon reference. The Wijekoon reference discloses a chemical-mechanical polishing device 11. The chemical-mechanical polishing device 11 includes a rotatable platen 15 on which a polishing pad 17 for polishing semiconductor wafers is mounted. The chemical-mechanical polishing device 11 further includes a fluid arm 25 having a slurry/chemical polishing fluid supply line 25a for supplying polishing fluid to the polishing pad 17 from a polishing fluid source 26a, and a conditioning chemical fluid supply line 25b for supplying a conditioning fluid to the polishing pad 17 from a conditioning fluid source 26b. The Wijekoon reference does not disclose or fairly suggest a first container having a supply of non-abrasive solution therein and a second container having a supply of a non-abrasive lubricant-additive therein. The Wijekoon reference teaches the opposite by disclosing a slurry/chemical polishing fluid supply line 25a for supplying an *abrasive* solution to the polishing pad 17. As known in chemical-mechanical polishing technology, a slurry, as disclosed in the Wijekoon reference, is a fluid including abrasive particles. The Wijekoon reference also fails to disclose a nozzle for dispensing lubricating planarizing solution. The Wijekoon reference is silent as to how the fluid supply line 25a and the conditioning chemical fluid supply line 25b dispense fluids.

### **The Claims and Rejections**

Turning now to the claims, the patentably distinct differences between the cited references and the claim language will be specifically pointed out. Independent claim 60 recites, in part, “a non-abrasive lubricating planarizing solution without abrasive particles on the polishing pad, the lubricating planarizing solution having *a viscosity of at least approximately between 4-100 cp.*” (Emphasis Added). The Molnar reference does not disclose a non-abrasive lubricating planarizing solution having *a viscosity of at least approximately between 4-100 cp.* Therefore, independent claim 60 is allowable over the Molnar reference. Claims depending from claim 60 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

The Examiner asserts that the viscosity limitations recited in claim 60 are process limitations and are, therefore, not given any patentable weight in an apparatus claim. The viscosity limitation further defines a structural feature of the planarizing machine of claim 60. The viscosity limitation is a physical property of the non-abrasive lubricating planarizing

solution which is a component of the planarizing machine of claim 60. The viscosity limitation defines a physical property of a component of the machine similar to a limitation such as density or strength of a structural component. Therefore, the viscosity limitations should be given patentable weight. Furthermore, the recited viscosity range does not appear to be disclosed by the Molnar reference.

The Examiner also asserts that because viscosity may be temperature dependent, a limitation on temperature should be recited in claim 60 in combination with the viscosity range. While viscosity may be temperature dependent, a temperature range is not required for claim 60 or any of the claims reciting a viscosity limitation to be definite. The scope of claim 60 or any of the claims reciting a viscosity limitation apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph.

Independent claim 61 recites, in part, “a first container and a supply of a *non-abrasive solution* in the first container; a second container and a supply of a *non-abrasive lubricant-additive* in the second container; and a mixing site coupled to the first and second containers, the lubricant-additive being mixed with non-abrasive solution at the mixing site to produce a lubricating planarizing solution, and the mixing site being coupled to a nozzle to dispense the lubricating planarizing solution onto the polishing pad.” Neither the Molnar reference nor the Wijekoon reference teach or suggest a first container having a supply of a non-abrasive solution therein and a second container having a supply of a non-abrasive lubricant-additive therein. In fact, the Wijekoon reference teaches away from the above limitations by disclosing a slurry/chemical polishing fluid supply line 25a for supplying an *abrasive* solution to the polishing pad 17. The Molnar reference does not remedy the deficiencies of the Wijekoon reference. Furthermore, neither the Molnar reference nor the Wijekoon reference teaches or suggests a nozzle configured to dispense lubricating planarizing solution, the nozzle being coupled to a mixing site. Therefore, independent claim 61 is allowable over the Molnar reference. Claims depending from claim 61 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

With respect to the rejections for use of the trademark names POLYOX® and CARBOPOL®, the specification has been amended to recite the chemical compositions of these products pertinent to the invention as known at the time the application was filed. The chemical

compositions of these products are therefore clear from the specification. Accordingly, withdrawal of the rejection of the claims on this ground is respectfully requested. In addition, Applicants have amended the specification and claims to change the typographical error in the name CARBOGEL®, to the correct name CARBOPOL®. This does not introduce any new matter because the error is based on an initial typographical error that was carried through the entire specification and overlooked during review. Applicants are not aware of any product by the named CARBOGEL®, and in fact, CARBOPOL® is what was used. Dependent claims 76, 78, 80, 82, 98, 100, 102, and 104 have been amended to recite the generic terminology for the products CARBOPOL® and POLYOX®. Namely, POLYOX® has been replaced with the phrase ethylene oxide polymers and CARBOPOL® has been replaced with the phrase homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether.

All of the claims remaining in the application (claims 60-105) are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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